

On the causes in the contemporary decline in the gully head retreat rates in Udmurtia

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2018 Russian Academy of Sciences. All rights reserved. Results of long-term monitoring of gully head retreat rates (GHRR) during almost the entire recent phase of global warming (1978-2014) in different parts of the Udmurt Republic are analysed. Assessment of the influence of different climatic parameters on GHRR in different parts of Udmurtiya and the whole territory in the two time intervals (1978-1997 and 1998-2014) is the main content of article. It was determined that GHRR decreased from 1.3 m yr⁻¹ in 1978-1997 to 0.3 m yr⁻¹ in 1998-2014. Based on the observation data that have been collecting nearby Izhevsk twice a year (after snow-melting and in autumn after period of rain-storms events), some changes were found in the relative contribution of snow-melting and rainfall events to GHRR. Some 80% of gully head retreat was occurring during the snow-melt season in the period 1978-1997, and only 53% - after 1997. Increasing influence of the rain-fed runoff manifested more clearly in the eastern and northern parts of the Vyatka-Kamsa interfluvium, while in the West, higher correlation was found between GHRR and frozen soil depth in winter. The most significant increase of gully length occurs during the warm part of the year and is related to rains that produce daily precipitation layer of >40 mm.

<http://dx.doi.org/10.7868/S0435428118010078>

Keywords

Gully head retreat rate, Hydro-climatic parameters, Monitoring, Spatialtemporal analysis, Udmurt Republic

References

- [1] Ovrashnaja erozija vostoka Russkoj ravniny (Gully Erosion in the east part of the Russian Plain). Dedkov A. P. Ed. Kazan: Izd-vo Kazan. Un-ta (Publ.), 1990. 142 p.
- [2] Bazhenova O. I., Lyubcova E. M., Ryzhov Yu. V. and Makarov S. A. Prostranstvenno-vremennojanalizdinamiki erozionnyh processov najuge Vostochnoj Sibiri (Spatiotemporal analysis of the dynamics of erosion processes in the south part of the Eastern Siberia). Novosibirsk: Nauka (Publ.), 1997. 208 p.
- [3] Ryzhov Yu. V. Prostranstvenno-vremennye zakonomernosti formirovaniya i razvitiya ovragov najuge Vostochnoj Sibiri (Spatiotemporal patterns of the formation and development of gullies in the Southern East Siberia): Doctor of Science thesis. Tomsk. 2013. 32 p.
- [4] Pronicheva M. V. About growth rates of gullies of the Central Russian Upland. Tr. IGANSSSR. Mater. Geomor. Paleogeogr. 1955. Vol. 65. No. 14. P. 87-111. (in Russ.)
- [5] Korotina N. M. The growth rate of gullies in Ulyanovsk Volga Region. Geomorfologiya (Geomorphology RAS). 1981. No. 4. P. 78-83. (in Russ.)

- [6] Mironova E. A. and Setunskaya L. E. Some results of the study of gully growth intensity on the Privolzhskaya Upland. *Geomorfologiya* (Geomorphology RAS). 1974. No. 3. P. 74-82. (in Russ.)
- [7] Nazarov N. N. *Ovrazhnaya eroziya v Prikam'e* (Gully erosion in the Kama region). Perm: Izd-vo Perm Un-ta (Publ.), 1992. 103 p.
- [8] *Geografija ovrazhnoj erozii* (Geography of gully erosion). E. F. Zorina. Ed. Moscow: Izd-vo MGU (Publ.), 2006. 324 p.
- [9] *Ovrazhnaya eroziya* (Gully erosion). R. S. Chalov. Ed. Moscow: Izd-vo MGU (Publ.), 1989. 168 p.
- [10] Rysin I. I. *Ovrazhnaya eroziya v Udmurtii* (Gully erosion in Udmurtia). Izhevsk: UdGU (Publ.), 1998. 274 p.
- [11] Rysin I. I. and Grigor'ev I. I. The influence of hydrometeorological agents on the ravine growth in Udmurtia. *Vestn. Udmurt Univ. Ser. Biol. Nauki o Zemle*. 2010. No. 4. p. 137-146. (in Russ.)
- [12] Sherstjukov A. B. Correlation of soil temperature with air temperature and snow cover depth in Russia. *Kriosfera Zemli*. 2008. Vol. XII. No. 1. p. 79-87. (in Russ.)
- [13] Park H., Sherstjukov A., Fedorov A., Polyakov I. and Walsh J. An observation-based assessment of the influences of air temperature and snow depth on soil temperature in Russia. *Environmental Research Letters*. 2014. Vol. 9. No. 6. 064026 (7 p.).
- [14] Golosov V. N., Gennadiev A. N., Olson K. R., Markelov M. V., Zhidkin A. P., Chendev Ju. G., and Kovach R. G. Spatial and temporal features of soil erosion in the forest-steppe zone of the East-European Plain. *Pochvovedenie*. 2011. No. 7. p. 861-869. (in Russ.)
- [15] Petelko A. I., Golosov V. N., and Belyaev V. R. Experience of design of system of counter-erosion measures. *Proc. 10 Int. Symp. on River sediment*. 2007. Vol. 1. P. 311-316.
- [16] Perevedencev Ju. P., Shantalinskij K. M., and Vazhnova N. A. Spatiotemporal Variations of Major Parameters of Temperature and Humidity Regime in the Volga Federal District. *Meteorol. Gidrol*. 2014. No. 10. p. 19-31. (in Russ.)
- [17] Sobolev S. S. *Razyitie erozjonnyh processov na territorii evropejskoj chasti SSSR i bor'ba s nimi* (Development of erosion processes in the USSR European part and their control). M.-L.: Izd-vo AN SSSR (Publ.), 1948. Vol. 1. 305 p.
- [18] Lakin G. F. *Biometrija* (Biometrics). Moscow: Vysshaya shkola (Pbl.), 1990. 352 p.
- [19] Rysin I. I., Grigor'ev I. I., Zaytseva M. Ju. and Golosov V. N. Dynamic of linear retreat of gully head within Vyatsko-Kamskoe interfluvium on turn of the centuries. *Vestn. Mosk. Univ. Ser. 5. Geogr*. 2017. No. 1. P. 63-72. (in Russ.)